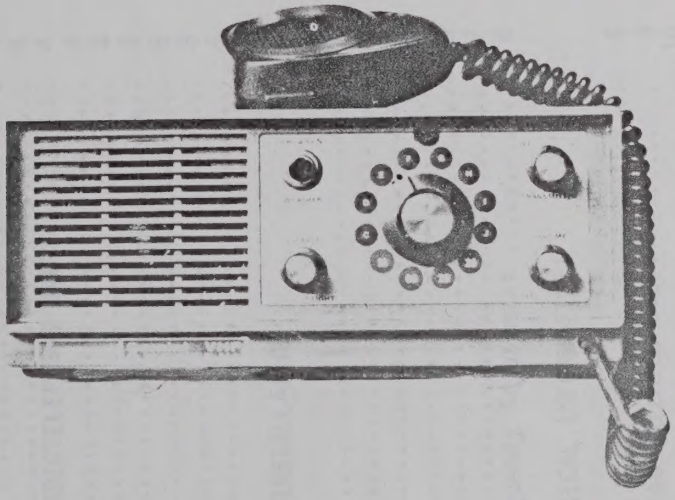
Manual #3222-06

konel

GEMINI II VHF/FM
Radiotelephone
KR-25VN

OPERATION & SERVICE MANUAL



konel corporation
271 Harbor Way, South San Francisco, California 94080

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PART 1. GENERAL INFORMATION

DESCRIPTION OF EQUIPMENT

nel model KR-25VN is a 12 channel plus weather marine VHF/FM diotelephone capable of operation on any of the marine channels signated by the International Telecommunications Union in the 6-157 and 161-162 MHz frequency ranges.

e equipment is suitable for installation aboard commercial or easure boats, and with ordinary care will provide years of re- able service. The transmitter has been designed to exceed the quirements of intermittent marine service, which is defined as 50% duty cycle of two (2) minutes transmitting followed by a riod of two (2) minutes receiving. Operating the transmitter thin these limits will provide normal tube life.

chanical construction: Chassis and cabinet are of heavy gauge eated aluminum, with stainless steel hardware throughout.

ked Epoxy painted exterior: All exterior surfaces fully protected th two coats of durable enamel.

ration engineered: Multiple tie points, safety staked rivets d double grounds guard against vibration failure.

vironment protection: All wiring is varnished against marine rosion. Transformers are double vacuum impregnated, speakers ve mylar coated waterproof cones.

iversal mounting: The unit may be conveniently installed in any sition; table top, bulkhead or overhead, and is easily removed r service or storage by loosening four thumb screws.

nponentry: Highest quality electrical components are used roughout. The chassis design permits easy maintenance of P.C. ards.

ter receptacle: A meter receptacle is provided which enables transmitter and receiver circuits to be monitored with a KTM-33 st meter.

note Control receptacle: A remote control receptacle is pro- ded which enables the radiotelephone to be operated (except annel changing) from two locations.

B. EQUIPMENT

1. Equipment Furnished

a. KR-25VN (13.6 volt DC internal power supply) radiotelephone complete with power input connector and antenna connector, or KR-25VN (external regulated power supply, either 115 volts AC or 24/34 volt DC - specify voltage when ordering) radiotelephone complete with interconnecting cable and antenna connector.

b. Microphone and hanger.

c. Instruction book, warranty card and FCC license forms.

2. Accessories Available

a. Test Meter KTM-33: Plug-in test meter useful for alignment and maintenance of receiver and transmitter.

b. Remote Control Unit RS-14M: Remote unit permits full control (except channel changing) of the radiotelephone from a second location (flying bridge, etc.). A circuit diagram of the unit is shown at rear of manual.

c. Selective Ringer Amplifier KRV-6: This small integrated circuit (IC) amplifier may be installed within the radiotelephone unit to operate any type of Ringer Receiving equipment. See your Konel dealer regarding available Ringer Receiving equipment.

3. Crystal Ordering Information

A chart is provided at the rear of the manual, which shows the marine VHF channel allocation numbers as well as channel and crystal transmit and receive frequencies.

Crystals may be ordered by channel number from your Konel dealer or from the following approved suppliers who have frequency correlation information on file. When ordering crystals to sure to include:

a. VHF channel number
b. Transmit crystal part number
   1. Land station, .0005%, part #2197
   2. Ship stations, .001%, part #2194
c. Receive crystal part number 2199
d. Crystal frequencies

e. Statement that crystals are for Konel VHF model KR-25VN. Be specific. Some channels are USA use only. Note suffix letter in frequency list.

Approved Crystal Suppliers:

night, Inc. ich, Ill. 60548	Sentry Mfg. Co. Crystal Park Chickasha, Okla. 73018	Sherold Crystals 1510 McGee St. Kansas City, Missouri 64108

Crystal frequencies are computed by the following formulas:

Receive crystal frequency (Mc) =

$$\frac{\text{Channel Freq. (Mc)} + 16.9\ \text{(Mc)}}{3}$$

Transmit crystal frequency (Mc) =

$$\frac{\text{Channel Freq. (Mc)}}{12}$$

TYPE ACCEPTANCE INFORMATION

KR-25VN radiotelephone has been type accepted for use under following Federal Communications Commission (USA) Parts and rtment of Transport (Canada) radio standards specifications;

1. Part 81, Stations on land when equipped with .0005% transmit crystals (Konel Part #2197).
2. Part 83, Stations on shipboard when equipped with .001% transmit crystals (Konel Part #2194).
3. Part 15, Receiver radiation.
4. R.S.S. 182, Stations on land when equipped with .0005% transmit crystals (Konel Part #2197). Stations on shipboard when equipped with .001% transmit crystals (Konel Part #2194).
5. R.S.S. 126, Land and Mobile stations when equipped with .001% transmit crystals (Konel Part #2194).

A. FRONT PANEL CONTROLS

1. Volume Control: The volume control also turns the power ON when rotated clockwise from a full counter-clockwise position. Clockwise rotation will increase the receiver volume.

2. Channel Selector Switch: The channel selector switch selects the appropriate transmit and receive crystals. The channel positions are designated by letters A through L on the panel. Operating channels should be identified on the front panel with the channel number labels provided. The location of crystal positions is shown along the edge of the crystal sockets inside the cabinet.

3. Squelch Control: The squelch control permits quieting of the receiver background noise when no station is being received. When the control is turned to its full counter-clockwise position the squelch is "OFF" and background noise will be heard. Adjust the volume control clockwise with the squelch off for proper listening level, then adjust squelch control clockwise for the amount of muting action desired (see squelch control operation).

4. Transmitter Power Switch: The transmitter power switch selects the power output to the antenna. This switch also turns the transmitter filaments "OFF" to conserve power when the radiotelephone is used for receiving only.

5. Weather Station Switch: When depressed, the weather station push button switch disconnects the receive channel selector switch assembly and the microphone press-to-talk switch and connects a weather station crystal to the receiver. When pressed again, the receiver is returned to normal operating condition.

C. OTHER OPERATING CONTROLS - RADIOTELEPHONE UNIT

1. Front Panel Lamp: The front panel lamp is provided for illumination at night (pull squelch control knob out from panel to turn lamp on).

2. Press-to-Talk switch: When the press-to-talk switch on the microphone is depressed, the receiver is disabled and the transmitter turned on. When released, the receiver will operate.

3. Antenna Connector: The antenna coaxial connector is located on the rear panel. This connector attaches to the UHF (SO-239) type connector on the transmission line from the 50 ohm antenna.

Remote Control: The "REMOTE" receptacle is located on the
ır panel. When the RS-14M remote unit cable is plugged into
s receptacle, the radiotelephone may be operated (except for
ınnel selection) from two locations.

RS-14M volume and squelch controls operate in parallel with
controls on the KR-25VN. For full volume and squelch control
either location, the volume control at the non-operating lo-
ion should be in the "off" position (counter-clockwise) and
squelch control in the "on" position (clockwise).

an emergency, the radiotelephone may be operated from either
both locations by turning either volume control "on" and oper-
ng in a normal manner.

Metering circuits: The KTM-33 test meter socket is located
the rear panel of the radiotelephone. The following circuits
be monitored with this meter;

Receiver channel oscillator and multiplier
Receiver alignment
Receiver discriminator balance

Transmitter crystal oscillator grid current
Transmitter multiplier grid current
Transmitter driver grid current
Transmitter final grid current
Transmitter power output
Transmitter power input to final amplifier tube

OPERATING TECHNIQUES

marine VHF frequencies on which the KR-25VN operates are shared
quencies. For this reason, the following operating procedures
uld be followed:

a. Be sure the channel is clear before transmitting.
b. Keep all communications short; others may want to use the channel.
c. Hold the microphone approximately one inch from your mouth, depress the push-to-talk button and speak clearly. Don't shout!
d. Identify your vessel: give your call sign and vessel's name at beginning and end of each transmission.
e. Use channels for purpose designated.
f. Keep an accurate log of all emergency and safety communications.
g. Watch your language. Use of profane or obscene language on the air is against the law!

A. KR-25VN RADIOTELEPHONE

1. Factory Adjustments: The equipment has been aligned at the factory to operate on any of the licensable VHF marine channels. The radiotelephone is supplied with a limited number of transmit and receive crystals installed. If additional channels are desired, two crystals will be required for each channel. Install in the proper crystal sockets and align each transmit crystal to exact frequency. No resonant circuit alignment of the transmitter or receiver will be necessary for operation on any of the VHF marine channels since associated circuits are broad band tuned.

NOTE: All transmitter adjustments must be performed by an FCC licensed technician.

2. Inspection of Equipment: The exterior and interior of the radiotelephone should be examined for any damage which may have occured in transit due to improper handling. Report damage promptly to the transportation company prior to disposing of the packing materials.

3. Location of Equipment: The radiotelephone may be conveniently mounted horizontally or vertically. It should be located in a position convenient to the operator and the technician to make routine inspections, and provide adequate ventilation. The microphone and hanger may be mounted in any location convenient to the operator.

The cabinet may be removed, exposing all tuning and frequency adjustments. Individual crystal frequency trimmers are provided for each transmitting channel; trimmers are located along side the transmitter crystal socket assembly. No receive crystal frequency alignment is required due to the Automatic Frequency Control circuit.

4. Input Power

a. KR-25VN/12: The power leads between the ship's battery source and the radiotelephone should be as short as possible to minimize voltage drop. The following wire sizes are recommended: #10 for cable runs up to ten feet; #8 for cable runs from ten to twenty-five feet.

The input power plug and socket allows quick connect and disconnect of the power circuit. The equipment will not be damaged if the polarity is reversed, but should this accidentally occur, the fuse located on the rear panel of the equipment must be replaced.

The KR-25VN is designed to operate on negative grounded power systems. For optimum performance and reliability the voltage at the power receptacle on the rear panel should be between 13.0 and 14.0 volts under transmit conditions.

b. KR-25VN/115: The 115 volt power source wiring circuit should be adequate to handle the transmitter power requirements. The voltage regulator circuit within this power supply will provide proper operation between 100 and 150 volts AC input.

c. KR-25VN/34: The power leads between the ships battery source and the power supply should be adequate to handle the transmitter power requirements of about 6 amps. The following wire sizes are recommended: #12 wire for cable runs up to ten feet; #10 wire for cable runs from ten to twenty-five feet.

Antenna System: The radio frequency transmitter power output fed directly to the antenna through a 50-ohm coaxial transmission e. Type RG-8/U transmission line (3 db loss per 100 feet) is ommended. For transmission line lengths of twenty-five feet or s, RG-58/U (6 db loss per 100 feet) transmission line may be stituted.

ce VHF radio waves ordinarily do not reflect from the ionosphere re is no long-distance "SKIP". For all practical purposes the munications range for VHF radio is considered to be "line-of- ht" or about 20 miles for ship-to-ship and up to 50 miles or e for ship-to-shore communications depending on antenna height terrain. The most important single factor being the height the sending and receiving antennas -- the higher the antennas, greater the range.

a. Marine Antennas: For shipboard installation a low gain 50 ohm coaxial antenna should be used. This type of antenna provides a steady signal when the ship is rolling or pitching due to the broader beam lobes. Automobile type antennas should NOT be used.

b. Base Station Antenna: The base station antenna should be as high as possible, FCC Rules and Regulations permitting. Local ordinances dealing with antenna height should be checked before antenna installation.

Base station antennas should be of a high gain type, exhibiting a low angle of radiation. This type of antenna can provide gains of up to 12 db which is equal to increasing the effective radiotelephone power output several times. High gain antennas also increase the strength of the received signal by an equal ratio as

previously mentioned. At VHF frequencies height is a most significant factor in determining communications range. (See Range nomograph at rear of manual)

6. Transmitter Crystal Frequency Adjustment: The frequency of the transmitter crystals may be accurately adjusted with the series trimmer condensers located on the crystal mounting assembly. Each crystal socket and trim condenser is identified in accordance with the channel selector switch position. The frequency of each crystal and the channel frequency is listed in the Channel Allocation Chart. When adjusting the transmitter frequency, disconnect the microphone (red wire) to prevent frequency modulating the oscillator and rotate the transmitter power switch to the 25 watt position. Connect a 50-ohm RF load (or wattmeter) to the antenna connector on the rear panel.

The Federal Communications Commission (FCC) and the Canadian Department of Transport (DOT) both require that all marine land station transmitters be within .0005% of the allocated channel frequency and all shipboard stations within .001%. A frequency meter or counter with an accuracy of 0.0001% or better, and capable of frequency measurement in the 156 to 157 Mc range will be required. The input of the frequency meter should be lightly coupled to the output of the transmitter. The actual frequency of the transmitter is computed by:

Transmitter frequency = Crystal frequency x 12

Turn the transmitter on by pressing the "push-to-talk" button and measure the frequency. Adjust the associated trimmer condenser for the precise operating frequency.

When all frequency adjustments are concluded, be sure to reconnect the microphone lead. Then place the transmitter power switch in the desired position.

DO NOT MAKE CHANNEL FREQUENCY ADJUSTMENTS WITHOUT INSTRUMENTS OF KNOWN ACCURACY

IMPORTANT NOTICE

All crystals age during the first year. A new crystal, placed on frequency, may age off frequency as much as 10 ppm. (.001%) at the end of the first year. For this reason, all transmitter frequencies MUST BE CHECKED after the first year, and should be checked annually thereafter.

PART IV TECHNICAL INFORMATION

RECEIVER SPECIFICATIONS

Type	Double conversion superheterodyne with broad band front end.
Frequency Range	156-163 MHz
Channels	12 plus weather
Sensitivity(20 db quieting)	Less than .5uv
Useable Sensitivity	.35uv for 12 db SINAD
Squelch Range	.2uv threshold (1 to 3uv tight)
I.F. Frequencies	1st I.F. 16.9 MHz,2nd I.F. 1.75 MHz
Spurious Response	Better than -75 db
Hum and noise	Better than -50 db
Adjacent Channel Atten.	(EIA) Better than 80 db
Audio Response	Within +2 to -8 db of true 6db per octave de-emphasis characteristic from 300 to 3000 Hz
Frequency Stability	.0005% (with AFC lock)

1. Transistors and Integrated Circuits

a. R.F. circuits

1 - 40673	R.F. amplifier
1 - 40673	1st converter
1 - 40673	16.9 Mc I.F. amplifier
1 - 40673	2nd converter
1 - PA189	1.75 Mc I.F. amplifier (I.C.)

b. Channel Oscillator Circuits

1 - 2N5485	AFC amplifier
1 - 2N3564	Crystal Oscillator
1 - 2N5180	Multiplier (x3)

c. Squelch Circuits

1 - 2N5485	Noise Amplifier
1 - 2N5485	D.C. Amplifier
1 - 2N4121	Trigger
1 - 2N3565	Trigger
1 - 2N5305	Squelch "OFF" control

d. Audio Circuits

1 - 2N5305	D.C. Volume Control
1 - 2N5485	Audio Source Follower
1 - PA237	Audio Amplifier (I.C.)
1 - D42C2	Audio power output amplifier
1 - D43C2	Audio Power Output amplifier

2. Receiver Circuitry

a. R.F. Circuits: The R.F. amplifier consists of a four tuned circuit pre-selector and a dual gate FET (Q102) amplifier. The inductive coupling of the pre-selector and inter-stage coils are broad-banded (over coupled) to provide a 6 MC pass-band (156-163 MC).

The first converter (156 - 163 MC to 16.9 MC) consists of a dual gate FET (Q103) with signal applied to gate #1 and L.O. injection applied to gate #2. The 16.9 MC output of the first converter is fed through a 16.9 MC crystal filter, which has a 6 db bandwidth of 13 KC to a 16.9 MC I.F. stage (Q104). The output of the 16.9 MC I.F. stage is fed to gate #1 of the second converter (16.9 MC to 1.75 MC). Gate #2 of the second converter (Q105) functions as a Pierce crystal oscillator which provides the injection signal.

The 1.75 MC output from the second converter is fed to the input of the PA-189 integrated circuit I.F. amplifier and limiter. The output of the I.F. amplifier I.C. drives a conventional double diode (1N3064) discriminator.

The first converter (Q103) receives its L.O. injection signal from the crystal oscillator (Q107) and multiplier (Q108) circuits. The multiplier transistor (Q108) functions as a tripler with an output frequency 16.9 MC above the channel frequency.

b. Audio Circuits: The audio output of the double diode discriminator is fed to the first audio amplifier (Q115) through a D.C. volume control transistor (Q114) and audio de-emphasis network (R161 & C150). The D.C. volume control transistor (Q114) functions as a variable resistor, whose value is controlled by the forward bias voltage applied to its base.

The audio output signal from the D.C. volume control circuit is applied to the gate of the first audio amplifier and squelch controlled transistor (Q115). The output of the first audio amplifier is applied to the input of the audio power amplifier integrated circuit PA-237. The one watt power output of PA-237 is connected to the input of a 3 watt complementary power amplifier P.C. board which drives the loud speaker.

c. Squelch Circuits: The KR-25VN receiver is equipped with a differential triggering circuit which permits the operator to set the received signal level required to open the squelch, independently of the signal level required to re-set the squelch. This type of circuit prevents audio "popping" when the received signal fades below the squelch opening level.

The squelch circuit is formed by a high pass audio filter L103, noise amplifier Q109, noise rectifiers CR102 and CR103, differential triggering cirucit Q110, Q111, Q112 and Q113 and squelch controlled audio amplifier Q115. The squelch circuit operates by detecting the effect a received radio signal has upon the noise output of the discriminator. In the absence of a signal, maximum audio noise is present. When a signal is received, this noise level is reduced in proportion to the strength of the carrier. The triggering sensitivity of the squelch circuit is controlled by the setting of the front panel squelch control.

In the absence of a signal, noise from the discriminator output is amplified by transistor Q109, rectified by diodes CR102 and CR103 and applied as a negative DC voltage to the gate of transistor Q110 to turn it off. A positive voltage is applied to the drain of audio transistor Q115 through resistor R152 and diode CR105 which permits audio to reach the loud speaker through audio power amplifier PA-237.

When the front panel squelch control is turned slightly "ON" (clockwise) a small positive voltage is applied to the base of transistor Q111 through resistor R147 thereby causing it to conduct. When Q111 conducts the positive drain voltage to Q115 is removed and the receiver audio output is silenced. This is the most sensitive setting of the squelch control (threshold).

When a carrier signal is received, the negative DC noise output from diodes CR102 and CR103 is reduced, proportional to the strength of the carrier, until Q110 conducts. When Q110 conducts, Q112 becomes forward biased and also conducts.. When Q112 is turned on, Q113 becomes forward biased, through resistor R151, and audio transistor Q115 is turned on permitting audio to pass through to the loud speaker.

As the squelch control is advanced past the threshold point, an increasing positive voltage is applied to the source of Q110 through resistor R146. The higher this positive source voltage is set, the stronger the carrier signal must be to lower the negative DC noise

voltage on the gate of transistor Q110 to cause it to conduct.

The maximum carrier signal level required to open the squelch is set by variable resistor control (Sq "B") on the board. Once transistor Q110 is turned on, transistor Q113 also conducts which removes the positive voltage from the emitter of Q110. This permits the D.C. noise voltage on the base of Q110 to rise to a high level before Q110 cuts off, thereby, re-setting the squelch and silencing the receiver. This action eliminates squelch "popping" as signals fade.

The threshold sensitivity of the squelch circuit is set by variable resistor control (Sq "A") on the P.C. board. This control adjusts the gain of the noise amplifier Q109.

To adjust the triggering levels of the squelch circuit, proceed as follows:

1. Turn front panel squelch control full "OFF" (counter clockwise).

2. Disable AFC circuit by shorting AFC terminal (located at front of P.C. board behind speaker - violet wire) to ground with clip lead.

3. Attach VTVM (10 volt scale) between squelch rectifier (test point "T" on bottom of P.C. board) and ground. Set for negative voltage.

4. Connect signal generator to antenna terminal, tune to channel frequency and then set attenuator to zero output.

SQUELCH CONTROL "A", THRESHOLD SENSITIVITY

1. With no signal input, set control "Sq A" on top of P.C. board until VTVM indicates maximum negative voltage (-3 volts or more). This is most insensitive setting.

2. Turn front panel squelch control clockwise until receiver just quiets (threshold).

3. Advance signal generator attenuator until squelch opens (about .3 to .5 microvolts). Note VTVM reading, then return attenuator to zero output.

4. To increase threshold sensitivity, rotate (Sq A" control until VTVM voltage approaches the reading noted in 3 above. Advance signal generator attenuator until squelch opens (about .1 to .2 microvolts). This is most sensitive setting.

LCH CONTROL "B", MAXIMUM RANGE

Turn front panel squelch control full "ON" (clockwise).

Set control "Sq B" on top of P.C. board for maximum resistance (toward red wire).

Advance signal generator attenuator to about 5 microvolts and set frequency deviation control to ± 5KC deviation.

Adjust tuning slug in T104 and T105 for minimum VTVM voltage reading (minimum crystal filter ripple).

Rotate "Sq B" range control back toward minimum resistance until squelch opens safely.

Turn signal generator attenuator back toward zero and note level where squelch re-sets (about .1 to .3 microvolts) then advance attenuator until squelch opens (about .5 to 2 microvolts).

d. Automatic Frequency Control (AFC) Circuit: The KR-25VN receiver is equipped with an AFC circuit which automatically tunes the receiver to the frequency of the transmitting station. This function is accomplished by slightly moving the frequency of the receiver channel crystal oscillator in accordance with the D.C. unbalance voltage developed by the discriminator.

When a station is received that is on a frequency slightly different than the frequency of the receiver, a positive or negative D.C. voltage is developed at the output of the discriminator. The magnitude and polarity of this voltage depends upon the amount of frequency difference and whether this difference is higher or lower than the receiver frequency. If the frequency of the station is higher than the receiver, the discriminator output voltage will be positive and if lower the voltage will be negative.

This discriminator output voltage is applied to the gate of junction FET Q106 through a two section RC filter. When the frequency of the station is higher than the receiver, a positive voltage is applied to the gate of Q106 causing more drain current to flow thereby reducing the forward bias on the crystal oscillator transistor Q107. Lower forward bias on Q107 increases the crystal oscillator frequency, thereby causing the frequency of the receiver to approach the frequency of the transmitting station.

To adjust the AFC circuit for proper operation, proceed as follows:

1. Disable AFC circuit by shorting AFC terminal (located at front of receiver P.C. board behind speaker - violet wire) to ground with a clip lead.

2. Connect positive lead of voltmeter (20,000 ohms per volt) or VTVM to test point marked "AFC Set" on bottom of P.C. board, Use 5 volt scale. Connect negative lead to ground.

3. Press "Weather" push button and very carefully tune top slug in oscillator coil T108 (#0931-18) for maximum meter reading.

4. Release "Weather" push button and rotate channel selector switch to chan. #6 or #16. Very carefully adjust A.F.C. control R129 (located near oscillator transistor, Q107) for maximum meter reading.

NOTE: The crystal oscillator frequency changes very rapidly when tuning slug and control are varied at maximum meter reading, therefore use care when making these adjustments.

5. Set KTM-33 function switch on "meter set zero" and adjust meter control for center zero. Advance function switch to "Rec. Disc. Bal." position.

6. Using the weather station as an accurate frequency source, slightly adjust top slug in oscillator coil (T108) until KTM-33 reads center zero.

7. If available, a 60MC frequency counter may be connected to the "AFC set" test point (thru a D.C. blocking capacitor) in place of the voltmeter. Slightly adjust top slug in oscillator coil (T108) until counter reads 59.8166 MC.

8. Release "Weather" push button and check frequency of other channel crystals. All crystal frequencies should be within ±1200 cycles of their correct frequency.

The operation of the AFC circuit may be checked as follows:

1. Connect VHF signal generator to antenna connector on rear of radiotelephone.

2. Set KTM-33 function switch on "meter-set zero" and adjust meter control for center zero. Advance function switch to "Rec. Disc. Bal." position.

3. Tune signal generator to center of channel (KTM-33 meter reads center zero).

4. Tune signal generator until meter reads 2 on either side of center zero, disconnect AFC short clip lead on AFC terminal and note if meter returns toward center zero.

5. Repeat test by tuning signal generator until meter reads 2 on opposite side of center zero, remove AFC short and note if meter returns toward center zero.

NOTE: If a voltmeter is connected to "AFC Set" test point, the reading may drop slightly when the AFC short is removed. The meter reduction should be about equal for step #4 and #5 above. If reduction is unbalanced, slightly re-adjust control R129 for balanced reduction.

B. TRANSMITTER SPECIFICATIONS

Frequency Range	156 - 157 Mc
Channels	12
PA Power Output	25 watts & 1 watt - ±10%
Modulation	Phase type, 100% capability, tapered audio
Frequency Stability	.0005% or ±0.001% @ -30° to +60°C (When supplied with approved crystals)
Frequency Multiplication	12 times
Deviation	±5 Kc (adjustable)
Spurious Emissions	Less than 50 uw
Power Amplifier Tube	GE Compactron-type 8156
Frequency Adjustment	Series padding condensers

Tube Line-up:

1 - 6CL8A	(tetrode) crystal oscillator (triode) phase modulator
1 - 6CL8A	(triode) frequency tripler (tetrode) frequency doubler
1 - 12GN7A	pentode doubler/driver
1 - 8156	power amplifier

1. Transmitter Circuitry: The transmitter tetrode crystal oscillator tube (6CL8A) uses 13 Mc fundamental cut crystals. The oscillator output is resistance-capacity coupled to the grid of the triode phase modulator. The output of the phase modulator is tuned to the crystal frequency and capacity coupled to the grid of a triode frequency tripler (6CL8A).

   The output of the tripler is tuned to three times (3x) the crystal frequency and capacity coupled to the grid of the tetrode doubler. The output of the tetrode doubler is tuned to six times (6x) the crystal frequency and capacity coupled to the grid of a pentode doubler/driver (12GN7A).

The plate circuit of the doubler/driver is tuned to twelve times (12x) the crystal frequency, and inductively coupled to the grid of the final amplifier (8156). The output of the final amplifier is also tuned to twelve times (12x) the crystal frequency and coupled to the 50-ohm antenna circuit through a two-section harmonic filter.

The transmitter audio circuitry consists of a carbon type microphone and a microphone-to-grid transformer. The microphone transformer in turn drives the speech clipper circuit consisting of 2 back-to-back Zener diodes. The output of the deviation control is fed to the grid of the phase modulator through an "LC" and "bridge T" low pass audio filter.

POWER SUPPLY CIRCUITRY

1. KR-25VN/12 volt DC Power Supply: The receiver DC power is obtained directly from the 13.6 volt primary source through the input power fuse. The transmitter plate supply is provided by a DC to DC converter consisting of two 2N3772 transistors, a power transformer and a filter circuit. A B+ voltage and negative bias are provided by the supply. The high voltage for the final power amplifier and driver stages is 420 volts. A negative bias voltage of 30 volts is applied to the final grid and negative 6 volts to the tripler and doubler grids. This bias protects the transmitter tubes should the excitation fail or the radiotelephone be operated on a channel without a crystal.

2. K-25/34 volt DC Regulated Power Supply: The KR-25VN 34 volt DC power supply is regulated by two switching type regulators, one for operating the 13 volt transmitter filaments and the receiver (continuous operation) and one for operating the transmitter high voltage and bias power supply (intermittent operation). The dual switching regulator will accept any input voltage from 20 through 50 volts.

   A switching type regulator is an efficient device since it delivers to the load only the amount of power required, therefore when the supply voltage goes up, the supply current goes down.

   Both regulators consist of the following elements:

   a. Q501, Q502, Q503 and Q510, Q511, Q512 - Series regulator elements.

   b. Q505, Q506 and Q514, Q515 - Mono-stable multivibrator

   c. Q507 and Q516 - Voltage sensitive trigger.

   d. Q504 and Q513 - Buffer-driver.

   When the radiotelephone front panel power switch is turned "ON", Q512 conducts (due to forward bias through R514) which turns on Q511 and Q510. When A510 is turned on, current flows through choke L502 developing a voltage across potentiometer R521. When the output voltage from potentiometer R521 exceeds 6 volts, zener diode CR508 conducts causing Q516 to conduct. When Q516 conducts, Q515 turns off causing mono stable multi Q514 and vuffer-driver Q513 to conduct. When the buffer-driver Q513 conducts, series elements Q510, Q511 and Q512 turn off and current ceases to flow to the output.

   When mono stable multi Q514 conducts, capacitor C507 is discharged which determines the "OFF" time of series elements Q510, Q511 and Q512. When capacitor C507 is discharged, Q515 again conducts permitting series elements Q510, Q511 and Q512 to again conduct. The ratio of "OFF" time to "ON" time is determined by the primary power line charge voltage on capacitor C507 thereby controlling the regulated output voltage.

   Inductor L502 and capacitor C508 filter the switched output voltage of the regulator and diode CR507 provides a DC return path for the inductive current from L502 when the series regulator elements Q510, Q511 and Q512 are turned off.

   The transmitter switching regulator operates when the primary power line relay K501 is actuated by the press-to-talk button on the microphone. The output voltage of the transmitter regulator is set for 16 to 18 volts which operates the inverter transistors Q508 and Q509. The transmitter high voltage is obtained from a full-wave rectifier and filter and the bias voltage is obtained from a half-wave rectifier and filter.

To adjust the output voltage of each regulator, proceed as follows:

A. Receiver Regulator

   1. Connect the positive lead of a voltmeter (25 volt scale) to terminal #3 or #4 of TB502. Connect negative lead to terminal #1 of TB502 (NOTE: The power supply chassis is not connected to ground or negative).

2. Connect input power to TB501 (24 to 48 volts). Turn on power supply (advance volume control knob on Radiotelephone).

3. Adjust control R521 (Rec.) on P.C. board until meter reads 13.6 volts.

Transmitter Regulator

1. Connect positive lead of a voltmeter (500 volt scale) to terminal #6 of TB502. Connect negative lead to terminal #1 of TB502.

2. Connect input power to TB501 (24 to 49 volts). Turn on power supply (advance volume control knob on Radiotelephone).

3. Set "Transmitter" switch on front panel of Radiotelephone to "25 watt" position and allow about 1 minute for transmitter tubes to heat.

4. Connect 50 ohm load to antenna connector on rear panel of Radiotelephone.

5. Press "Push-to-talk" button on side of microphone and adjust control R510 (Transmitter) on P.C. board until meter reads 420 volts.

K-25/115 Regulated AC Power Supply: The KR-25VN regulated AC power supply will automatically compensate for power line voltage variations between 100 and 150 volts. The regulator operates by automatically selecting the appropriate primary voltage tap on power transformer T402.

The voltage regulator is entirely contained on P.C. board assembly number 6074-01 and functions in the following manner: A power line voltage sensing transformer (T401) is connected to the unregulated power line. The secondary voltage will vary from 10 to 15 volts for power line variations of 100 to 150 volts. This secondary AC voltage is applied to the anodes of two silicon unilateral switches (2N4987) through two voltage adjusting potentiometers (R401 & R402). Potentiometer R401 (low voltage) is adjusted so that its silicon switch conducts when the line voltage reaches 120 volts and R402 (high voltage) is adjusted so that its silicon switch conducts at 135 volts. The silicon unilateral switches conduct when the peak positive cycle voltage reaches 8 volts, thereby, applying a half-wave rectified positive voltage to the base of transistors Q403 or Q404. When Q403 or Q404 has a positive voltage applied to its base, it conducts, thereby, closing relays K401 or K402.

Transformer T402 provides all voltages for the operation of the KR-25VN. These voltages are: 13.6 volts AC for the transmitter filaments, 13.6 volts DC for the receiver, -30 volts for transmitter bias and +380 and +420 volts for transmitter plate power.

To set the two voltage adjusting potentiometers on the regulator P.C. board, proceed as follows:

1. Connect an A.C. voltmeter (25 volt scale) between terminal #3 and ground on terminal strip TB401.

2. Connect a variable voltage transformer between the power line and the power supply.

3. Set both voltage adjusting potentiometers to "OFF" position (counter-clockwise).

4. Turn on power supply by advancing volume control knob on Radiotelephone.

5. Advance variable voltage transformer control until A.C. voltmeter reads 14.6 volts.

6. Turn "Low voltage" potentiometer (clockwise) until low voltage relay just closes. The AC voltmeter will drop to 12.6 volts.

7. Advance variable voltage transformer control until AC voltmeter again reads 14.6 volts.

8. Turn "High voltage" potentiometer (clockwise) until high voltage relay just closes. The AC voltmeter will again to 12.6 volts.

At these control settings the A.C. filament voltage will vary between 12.6 and 14.6 volts (15%) and the transmitter power output will vary between 20 and 30 watts over a power line voltage range of 100 to 150 volts.

PART V TUNE-UP ALIGNMENT

GENERAL INFORMATION

Konel KR-25VN receiver contains a number of unique design tures.

KR-25VN was accurately aligned at the factory and will not mally require anything more than alignment "touch-up" in vice to compensate for minor changes in component character- ics. However, in cases where major components have been re- ced or where the over-all sensitivity of the receiver falls ow .5 microvolts for 20 db quieting, the RF and IF sections uld be carefully realigned in accordance with the procedure -lined in the following paragraphs. Do not attempt to align s radiotelephone unless precision instruments are available.

Preliminary Tests and Checks: Any tuning adjustments to the transmitter must be made by an FCC licensed technician. Frequency and modulation adjustments may be made at time of installation or on a service bench provided the bench load conditions are equivalent to those of actual operation. The result of this adjustment should be entered in station log or radio log section of this Instruction Manual. (See FCC Rules Part 83-111).

Test Equipment Required: For complete receiver and transmitter alignment, including frequency adjustment, the following equipment will be required:

a. Signal Generator: A good, stable VHF signal generator with an accurately calibrated attenuator usable at signal levels of 0.5 microvolts or less. Frequency range, 156 to 162 Mc. Frequency modulation capability ±8 Kc or greater.

b. Signal Generator: A general coverage signal generator with accurate attenuator, for frequencies of 1.75 and 16.9 Mc.

c. Noise Generator: Silicon diode type with output in 150 to 170 Mc range (KTG-33 circuit shown at rear of manual).

d. Frequency Meter: A frequency meter with 0.0001% or better accuracy or a frequency counter is required for transmitter frequency alignment.

e. Wattmeter: 50 ohm load type

f. Volt-ohm meter: With 2.5 volt AC scale, or less.

g. Deviation Meter: Frequency modulation capability ±5 Kc or better.

h. Test Meter KTM-33: Plug in test meter for checking receiver and transmitter circuit operation.

i. Alignment Tools: Screw driver for slotted screws, two plastic hex alignment tools for #10 powdered iron cores in front end coils and one hex alignment tool for 1/4" cores in I.F. coils.

B. ALIGNMENT PROCEDURES

All measurements and meter readings are correct only when the radiotelephone primary power voltage, as measured at the power input connector, is as specified on the rear panel of the radio- telephone or external power supply.

1. Receiver Alignment Touch-Up: The receiver in the KR-25VN radiotelephone was accurately aligned at the factory using a special Sweep Generator and Noise Source. Becuase of the high selectivity and critical over-coupling of the front end R.F. coils, it is recommended that only touch-up procedures be used to obtain optimum receiver performance. A Noise Generator (KTG-33), Test Meter KTM-33 and a V.O.M. are the only alignment instruments required for this procedure.

   Before starting alignment, short AFC terminal (front of receiver P.C. board behind speaker - violet lead) to ground with clip lead.

   a. I.F. Alignment Touch-Up

      1. Plug test meter KTM-33 into meter socket on rear panel and place function switch in the "Align" position.

      2. Rotate the channel selector switch to a position without a crystal.

      3. Turn Radiotelephone on. Test meter should read about 1.5 for properly aligned and operating receiver. Touch-up tuning slugs in all I.F. coils, starting with the crystal filter input coil, for maximum test meter reading. (T104, T105, T106, T107 and bottom slug in T110).

4. To adjust discriminator balance, unscrew top tuning slug in coil T110 to top of coil. Rotate meter function switch to "Meter-Set Zero" position and set meter pointer to center zero (with center zero control on KTM-33). Rotate function switch to "Receive Disc. Bal." position and, with no input signal to the receiver, slowly adjust the top tuning slug into the coil to the first position where the meter pointer reads zero.

5. Connect the output of a VHF signal generator to the rear panel antenna receptacle and tune to the receiver channel frequency. With a generator output of about 100 microvolts slowly tune across the channel frequency while observing the test meter. The test meter pointer should swing from about 2 on one side of the scale to the same reading on the other side of the scale. (With no signal input the meter need not read center zero for the equipment to function normally; a no signal unbalance of ±2 scale divisions is acceptable).

b. R.F. Front End Alignment Touch-Up

1. Connect an A.C. voltmeter (2.5 volt scale - use "output" terminal or .01 mfd. D.C. blocking capacitor) to test point marked "TP" on bottom of P.C. board near I.C. PA-189. Connect other lead to chassis ground.

2. Rotate channel selector switch to any channel in the 156 MC band.

3. Connect the output of a diode noise generator (KTG-33) to the antenna terminal of the radiotelephone.

4. Turn noise generator "ON" and advance its level control. Note the amount the test meter reading increases. (If an increased test meter reading is not obtained, use procedure described under "Complete R.F. Front End Alignment").

5. Rotate channel selector switch to any channel in the 161 MC band. Again advance the noise generator level control while noting the amount the test meter reading increases. If there is more than a slight difference between the two increased test meter readings (about one or two scale divisions), the antenna and R.F. amplifier coils (T101, T102 and T103) should be touched-up as follows:

6. Rotate channel selector switch between 156 MC and 161 MC crystal positions while observing 1st mixer L.O. drive on KTM-33 test meter (Rec. Osc." position). If drive is not balanced (within 5 scale divisions) touch-up tuning of bottom slug in oscillator coil (T108) and top and bottom slugs in multiplier coil (T109) until a balanced reading is obtained. Do not adjust top tuning slug in oscillator coil (T108). This tuning adjustment is part of AFC circuit and described under "AFC Circuit" procedures.

7. Rotate channel selector switch between 156 MC and 161 MC crystal positions while simultaneously adjusting top and bottom tuning slugs in each R.F. coil (T101, T102 and T103) for maximum A.C. voltmeter reading. Because of the high selectivity of these R.F. coils, DO NOT turn slugs more than 1/8 turn at a time. Since these three coils are in cascade, a slight mis-alignment of any one of the six high Q tuned circuits can drastically reduce the sensitivity in either the 156 MC or 161 MC bands, resulting in unbalanced test meter readings thereafter. If the front end is seriously out of alignment, the "Complete R.F. Front End Alignment" procedure should be used.

2. Complete Receiver Alignment: All tuned circuits in this unit are iron core slug tuned and should require only touch-up tuning (if any) during the life of the equipment. Factory alignment procedures are outlined in the following two paragraphs.

a. Complete I.F. Alignment

1. Plug test meter KTM-33 into socket on the rear panel and place function switch in "Align" position. Apply a 1.75 MC unmodulated signal to gate #1 of Q105 the second mixer, through a .001 mfd capacitor and increase the generator output until the test meter reading increases. Adjust the tuning slug in the 1.75 Mc I.F. transformer (T107) and the lower slug in the discriminator transformer (T110) for maximum meter reading. Keep reducing the input signal level below the limiting level of PA-189 I.F. amplifier I.C. so the meter will indicate level change with tuning.

2. Apply a 16.9 Mc signal to gate #1 of the first mixer (Q103) through a .001 mfd capacitor. Increase signal generator output to 100 microvolts and carefully tune generator around 16.9 Mc until a meter reading is obtained. Reduce signal generator output until meter reading drops about 50%. Adjust tuning slug in 16.9 Mc I.F. coils (T104, T105 and top and bottom slugs in T106) for maximum meter reading (continue to reduce the signal generator output as the receiver response increases.

3. Remove signal generator from mixer (Q103) and check if R.F. front end is within range to receive a "noise signal". (Check by shorting gate #1 of Q103 to ground and noting if meter reading drops to a lower level). Assuming a "noise signal" is received, adjust tuning slugs in crystal filter input and output transformers (T104 and T105) for maximum meter reading. If the R.F. front end is not capable of producing a "noise signal" return to this step after R.F. front end alignment has been completed.

4. If the R.F. front end is aligned, the discriminator transformer, T110, may be balanced according to procedures described in paragraph 4 of I.F. Alignment Touch-Up Procedure. If the R.F. front end is not aligned return to this step after R.F. front end alignment has been completed.

Complete R.F. Front End Alignment

The KR-25VN contains a highly selective R.F. front end consisting of one R.F. stage and mixer. Three double tuned and over-coupled R.F. transformers provide the necessary broad-banding to permit reception in both the high frequency band (161-162 Mc) and the low frequency band (156-157 Mc). Because of the balanced selective nature of this R.F. front end, complete alignment should not be attempted unless absolutely necessary. If the R.F. front end touch-up procedures previously described are ineffective, the following procedures should be followed:

1. Disable the AFC circuit by shorting the AFC terminal (located at front of P.C. board behind speaker - violet wire) to ground with clip lead.

2. Connect an A.C. voltmeter (2.5 volt scale - use "output" terminal or .01 mfd. D.C. blocking capacitor) to test point marked "TP" on bottom of P.C. board near I.C. PA-189.

Connect other lead to chassis ground.

3. Rotate function switch on KTM-33 test meter to "Rec. Osc." position.

4. Rotate channel selector switch between 156 Mc and 161 Mc crystal positions while observing 1st mixer L.O. drive on KTM-33 test meter. If drive is not balanced (within 5 scale divisions) touch-up tuning of bottom blug in oscillator coil (T108) and top and bottom slugs in multiplier coil (T109) until a balanced reading is obtained. Do not adjust top tuning slug in oscillator coil (T108). This tuning adjustment is part of AFC cirucit and described under "AFC Circuit" procedures.

5. Rotate channel selector switch to 161 Mc band channel crystal, tune signal generator to this frequency and advance attenuator until an increased test meter reading is obtained on A.C. voltmeter.

6. With receiver placed on edge, tune top and bottom tuning slugs in each R.F. transformer simultaneously (T101, T102, and T103). Start with any one of the three R.F. transformers and peak both tuning slugs to the high band channel frequency. Be sure that the tuning slugs are on the outside of the transformer coils. Reduce signal generator output as alignment progresses for unsaturated meter reading.

7. Rotate channel selector switch to 156 Mc band channel crystal, tune signal generator to this frequency and advance attenuator until an increased test meter reading is obtained on A.C. voltmeter.

8. Very carefully turn the top and bottom tuning slugs of each transformer, simultaneously, further toward the center of the transformer until a peak is obtained on the A.C. voltmeter. Be sure neither tuning slug is turned past the peak thereby compensating for the position of the opposite tuning slug.

9. At this point the R.F. front end should be virtually aligned, permitting the I.F. and R.F. touch-up procedures to be followed.

Receiver Sensitivity Measurement: After all receiver stages have been accurately aligned with a noise generator, the overall sensitivity for 20 db quieting should be checked.

Measure receiver sensitivity as follows: Disable the AFC circuit by shorting the AFC terminal (located at front of P.C. board behind speaker - violet wire) to ground with clip lead. Connect a VHF signal generator through a 6 db pad attenuator and a 40 inch length of RG-58/U cable, to the rear panel antenna receptacle, Connect a db meter across the speaker voice coil and advance the receiver volume control (squelch control "off") until a convenient noise level reading is obtained on the db meter. Carefully tune the signal generator to the channel frequency until a minimum noise reading is obtained on the db meter. Adjust the signal generator output attenuator until the db meter reading is 20 db lower than the reading obtained with no input signal. The signal generator output attenuator including the pad attenuator loss, will indicate the microvolt input signal to the receiver required to obtain 20 db quieting. A properly operating receiver should require .5 mv or less for 20 db quieting with full input voltage.

TRANSMITTER ALIGNMENT

or to making any transmitter tuning adjustments, place the transter power switch in the 1 watt position. Connect a 50 ohm ixial R.F. load (or wattmeter - 30 watts or higher) to the enna connector on the rear panel. Allow one minute for the nsmitter tubes to warm up. All meter readings and alignment cedures will be described using accessory test meter KTM-33.

1. Crystal Oscillator: Place the test meter function switch in the "Trans. Osc." position. Plug a channel 16 (156.80 Mc) crystal into one of the transmitter crystal sockets and rotate the channel selector switch to this position.

   CAUTION: In keying a detuned transmitter only key for approximately 10 seconds at a time to aviod possible overload conditions which could result in loss of tube life.

   The transmitter has fixed bias on all R.F. amplifier stages to protect the tubes if keyed on a channel without a transmitter crystal installed.

   Turn the transmitter ON by pressing the push-to-talk button on the microphone and observe the test meter to verify that the crystal is oscillating (approximately mid-scale reading).

2. Multiplier Stages: Advance the meter function switch to the "Mult. Grid" position. Press the push-to-talk button and tune the 39 Mc coil (T201) for maximum meter reading. Advance the meter function switch to the "Driver Grid" position and tune 78 Mc coil (T202) for maximum meter reading.

   Advance the meter function switch to the "Final Grid" position and tune the driver plate (top) and final grid (bottom) tuning slugs (T203) for maximum meter reading.

3. Final Power Amplifier: Turn the meter function switch to the "Power Output" position and place the transmitter power switch in the 25 watt position. Press the push-to-talk button and tune the final plate (T204) tuning slug and antenna capacitor (C222) for maximum meter reading.

   The test meter should read about 25 on the 0-100 scale and a watt-meter should indicate 25 watts power output. The power output is dependent upon power line voltage. The KR-25VN/12 is designed to give rated power output with 13.6 volts DC measured at the power input connector under transmitter load conditions. The regulated power supplies used with the KR-25VN/115 and /34 will provide rated power output over a very wide range of input voltages.

   a. To measure the transmitter plate power input, place the test meter function switch in the "External 2.5V (250 Ma.) position. Plug a pair of test leads in the pin jacks marked - (black) and + (red). Connect the probe ends of the test leads across the 10 ohm resistor, located near the relay on the transmitter P.C. board, with the negative lead closest to the relay.

      BE EXTREMELY CAREFUL, as 400 volts is connected to the 10 ohm resistor. Be sure the transmitter power switch is in the desired position.

      Press the push-to-talk button on the microphone and note the reading on the 0-250 Ma. scale of the test meter. A reading of about 135 Ma. (50 watt input) is normal with full supply voltage. A reading of about 20 Ma. should be obtained in the 1 watt position.

   b. Rotate the meter function switch to the "External-1000 volt" position. Remove the probe end of the black test lead from the 10 ohm resistor and connect to chassis ground. Press the push-to-talk

button on the microphone and note the reading on the 0-1000 scale (1000 volts full scale) of the test meter. A reading of about 420 volts is normal with full input supply voltage.

The transmitter plate power input to the final amplifier tube may be calculated as follows:

Watts = Plate voltage x Plate current in amperes

4. Modulation Deviation Adjustment: All frequency modulated transmitters (marine, mobile, FM broadcast, etc) use phase modulation. Phase modulation is the only type of frequency modulation permitted by international law. With phase modulation, the frequency deviation doubles as the frequency of the audio signal doubles.

All communication type FM radiotelephones are required, by law, to contain a "speech clipper", to prevent overmodulation, and an "audio roll-off filter" to reduce the speech clipper harmonics above 3000 cycles.

Due to the excellent audio frequency response of the KR-25VN transmitter, the modulation deviation must be adjusted to ±5 KC at an audio frequency of 2600 cycles. To adjust the modulation deviation, proceed as follows:

1. Connect the low impedance output (500 ohms or less) of an audio signal generator between the microphone terminal on the transmitter P.C. board (red lead) and ground.

2. Connect a 50 ohm R.F. load (50 ohm wattmeter - 30 watts or higher) to the antenna connector on the rear panel of the radiotelephone unit.

3. Key the transmitter and tune a suitable deviation meter to the 156-157 MC output frequency.

4. Set the audio signal generator for an output of 4 to 5 volts R.M.S. at 2600 cycles.

5. Adjust the "Deviation" control on the transmitter P.C. board for ±5 KC maximum peak deviation. The sum of both plus and minus deviation should not exceed 10 KC maximum.

As the frequency of the audio signal generator is reduced, the modulation deviation will decrease. At frequencies higher than 3000 cycles, the audio roll-off filter will cause the deviation to decrease at a rate of about 12 db per octave.

High level audio at frequencies below 1500 cycles will produce considerable distortion due to:

a. The speech clipper produces distortion overtones at multiples of the fundamental audio frequency.

b. These distortion frequencies are below the 3000 cycle roll-off frequency of the audio filter.

c. These high distortion frequencies produce more frequency deviation than the fundamental - hence they are amplified more.

These distortion characteristics are normal for all FM radiotelephones and should cause no concern. The de-emphasis network in the receiver's audio circuitry equalizes the phase modulation characteristics of the transmitter and the listener hears a normalized audio signal. Most deviation meters provide an earphone output which includes a 750 microsecond de-emphasis network similar to the network in F.M. receivers. An oscilloscope connected to this output will provide a true picture of the transmitter's audio fidelity.

PART VI MAINTENANCE

SERVICING

riodic checks should be made by properly qualified technical rsonnel to ensure optimum performance at all times and to cor- ct any condition which could later result in equipment failure. nce the Konel VHF receiver differs considerable in its design om conventional marine receivers, no attempt should be made to rvice the equipment until a thorough understanding of the basic rcuits and the characteristics of FM radiotelephones is acquired.

rvicing may be simplified by reference to the block diagrams d schematic diagrams at the end of this manual.

e approach is to localize the source of trouble and eliminate ose sections of the equipment which are operating normally. lways check the entire installation for defective antenna con- ections, loose or broken microphone wires or some other condition mpletely external to the set before actually removing the equip- ent for servicing.

. Preventive Maintenance: To ensure maximum performance, a routine program of preventive maintenance should be established, and should include the following points:

a. Check plugs, connectors, tubes and fasteners for proper seating.

b. Check for dust accumulation. Remove dust with small brush or dry compressed air.

c. Check relay contacts. Use a relay burnish tool or clean by drawing a small strip of ordinary bond paper between contacts while holding gentle pressure on relay armature. DO NOT USE FILE OR SANDPAPER ON CONTACTS. Disconnect the input power before attempting to clean the relay.

d. Check battery connections. Add water and clean terminals when required.

e. Check antenna system carefully. Look for corroded coaxial plug or socket connections. Check continuity of center coax conductor and outer shield. Check resistance between connections.

f. Check input power system and remote control wiring. Check for loose connections and corrosion of plugs and receptacles. Check wiring for kinks, pinches and abrasions from other moving parts.

g. Check radiotelephone for minimum performance. Receiver sensitivity - better than .5 microvolts for 20 db quieting. Transmitter output better than 20 watts at rated input voltage.

h. Check transmitter input to antenna system. Use thru-line type R.F. wattmeter. Power input to antenna should be better than 20 watts at rated input voltage.

i. Check antenna "reflected" power with thru-line type wattmeter when transmitting. Reflected power should be almost negligible if antenna and coaxial transmission line and transmitter are in proper order.

Trouble-Shooting Guide: To locate trouble use KTM-33 test meter to isolate the section of the set which is causing the trouble. Refer to the block diagram and voltage/resistance chart, and the schematic diagrams.

a. Power Supply (isolated from all loads)

Inoperative	(1) defective fuse (2) defective ON-OFF switch (3) defective transformer
Blown fuse	(1) defective transistors (2) reversed battery polarity (3) defective transformer (4) defective rectifier (s) (5) defective filter capacitor
Low output voltage	(1) low supply voltage (2) defective rectifier (s) (3) defective filter capacitor (4) defective voltage regulator

b. Transmitter (power supply satisfactory)

Inoperative (no output)	(1) defective tube (s) (2) defective control relay (3) defective crystal or no crystal
Operative (low output)	(1) defective tube (s) (2) out of alignment (3) faulty antenna system (4) Transmitter power switch in 1 watt position

Modulation deviation low	(1) defective microphone or microphone cable (2) low microphone voltage (3) defective speech limiter, Zener diode (4) defective modulator tube (6CL8A) (5) check deviation control setting and percent modulation
Modulation distorted	(1) check receiver and transmitter frequencies (2) check deviation control setting and percent modulation (3) check transmitter frequency alignment (4) defective modulator tube (6CL8A)
Frequency out of tolerance	(1) defective oscillator tube (6CL8A) (2) defective crystal (3) faulty crystal padding condenser

c. Receiver (power supply satisfactory)

Inoperative	(1) defective transistor (s) (2) defective volume control circuit (3) defective components (4) check "B" voltage (5) check control relay and antenna circuit
Squelch inoperative	(1) defective squelch transistors (2) check adjustment of squelch triggering level controls (Sq A & Sq B) (3) defective squelch diodes (1N3064) (4) defective component (s)
Operative, low sensitivity	(1) defective transistor (s) (2) check "B" voltage (3) defective antenna system or cable (4) defective receiver crystal (s) (5) out of alignment

Operative, audio distorted	(1) check transmitter frequency (2) defective audio IC (PA237) (3) defective transistor (s) (4) defective volume control circuit (5) faulty discriminator adjustment (6) out of alignment (7) defective loudspeaker
Limited communication range	(1) check antenna system thoroughly (2) check power into antenna and SWR with "Thru-line" type wattmeter (3) check position of transmitter power switch (4) check transmitter frequency (5) check modulation deviation (6) check terrain and expected range (see range chart)

PART VII PARTS LIST

A. Chassis & Front Panel

1	0437-05	Squelch control
1	0443-01	Volume control
1	4254-01	R.F. filter assembly
1	1422-50	Weather switch
1	1442-50	Transmitter Power Switch
1	2057-05	Speaker
1	2447-15	Lamp, 24 volt
3	2464-52	Knob, 1/2" with insert
1	2464-55	Knob, pointer with insert
1	3477-45	Channel marker labels
1	3601-50	Microphone
1	3601-04	Microphone hanger

B. Receiver P.C. Board, Assembly #4241

1	0425-25	Trimpot, AFC adjust
1	0425-25	Trimpot, Squelch A
1	0425-25	Trimpot, Squelch B
3	0931-07	R.F. coils & Mult. coil
1	0931-18	Oscillator coil
2	1014-05	Crystal filter coupling coil
1	1014-06	IF coil, 16.9 MC
1	1015-08	Crystal filter, 16.9 MC
1	1016-12	IF coil, 1.75 MC
1	1016-16	Discriminator coil
1	1611-07	Zener Diode, 10 volt (1N4740)
1	2186-05	Crystal, 15.15 MC
1	7025	Receiver P.C. board
1	0931-09	Antenna coil

C. Transmitter P.C. Board, Assembly #4242

1	0425-25	Deviation control
1	0801-50	Antenna tuning capacitor
1	1012-04	Audio filter choke
1	1035-04	Multiplier coil, 39 MC
1	1035-05	Multiplier coil, 78 MC
1	1036-03	Driver coil, 156 MC
1	1055-02	Final amplifier coil
1	1130-03	Microphone transformer
1	1511-05	Relay 4PDT, 12 volt coil
1	2435-08	Tube socket, 8156
3	2431-04	Tube socket, 9 pin
1	7019	Transmitter P.C. board

D. Channel Crystal Switch, Assembly #4243

12	0801-50	Frequency Adj. capacitors
2	1463-08	Switch wafer, 12 position
1	1463-09	Switch wafer, shorting
1	1496-75	Switch index, 12 position
2	2396	Crystal socket assembly
1	7027	Transmitter Crystal P.C. board
1	7029	Receiver crystal P.C. board
2	5599	Crystal hold-down bracket

E. Power Supply, 13.6 volt Rear Panel

1	0737-10	Electrolytic filter, 4 x 4/450 volt
1	0915	Hash choke
1	1249-26	Power transformer
1	1510-04	Relay, SPST, 12 volt coil

F. K-25/34 Regulated Power Supply

2	1106-12	Choke
1	1249-28	Power transformer
1	1510-04	Relay, SPST, 12 volt coil
1	2447-15	Lamp, 24 volt
2	0425-05	Trimpot, 5K
1	7068	Regulator P.C. board
1	3621-10	Cable Assembly, 10 wire & plug

G. K-25/115 Regulated Power Supply

1	1281	Power transformer
1	1510-04	Relay, SPST, 12 volt coil
2	1511-05	Relay, 4PST, 12 volt coil, P.C. board
2	0411-03	Trimpot, 250 ohm
1	1281-10	Voltage sensing transformer
1	7064	Regulator P.C. board
1	3621-10	Cable assembly, 10 wire & plug